

What is claimed is:

1. A camera signal processing apparatus comprising:
 - an interpolated pixel data generating means for interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;
 - a correlation detecting means for detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data generated by said interpolated pixel data generating means;
 - a normalizing means for normalizing said correlation value detected by said correlation detecting means in each of said at least two directions to generate a normalized value indicative of a relative value of said correlation value of each of said at least two directions;

a correcting means for adding a predetermined correction value to said normalized value generated by said normalizing means;

a weighting means for weighting said interpolated pixel data in each of said at least two directions generated by said interpolated pixel data generating means with said normalized value obtained by adding said correction value to said interpolated pixel data in each of said at least two directions and adding together the weighted interpolated pixel data in all of said at least two directions to generate interpolated pixel data; and

an image generating means for generating an image based on said interpolated pixel data weighted by said weighting means.

2. The camera signal processing means as set forth in claim 1, further comprising:

a control means for controlling said correcting means, wherein said control means generates said correction value in a range of -1 to 1 to have said correcting means add said correction value to said normalized value.

3. The camera signal processing means as set forth in claim 1, further comprising:

a limiting means for limiting said normalized value corrected in each of said at least two directions by said correcting means, wherein said limiting means limits said normalized value detected by said correlation detecting means in each of said at least two directions to a range of 0 to 1.

4. A camera signal processing method comprising the steps of:

interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data;

normalizing said correlation value in each of said at least two directions to generate a normalized value indicative of a relative value of said correlation value in each of said at least two directions;

adding a predetermined correction value to said normalized value;

weighting said interpolated pixel data in each of said at least two directions with said normalized value obtained by adding said correction value to said interpolated pixel data in each of said at least two directions and adding together the weighted interpolated pixel data in all of said at least two directions to generate interpolated pixel data; and

generating an image based on said weighted interpolated pixel data.

5. The camera signal processing method as set forth in claim 4, wherein, when adding said normalized value to said correction value, said correction value is generated in a range of -1 to 1.

6. The camera signal processing method as set forth in claim 4, wherein, after adding said correction

value to said normalized value, said normalized value is controlled to fall within a range of 0 to 1.

7. A camera signal processing apparatus comprising:

an interpolated pixel data generating means for interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

a correlation detecting means for detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data generated by said interpolated pixel data generating means; and

a weighting means for weighting said interpolated pixel data in each of said at least two directions generated by said interpolated pixel data generating means with said correlation value detected by said correlation value detecting means in each of said at

least two directions and adding the weighted interpolated pixel data in said at least two directions to generate interpolated pixel data.

8. The camera signal processing apparatus as set forth in claim 7, wherein said interpolated pixel data generating means performs interpolation on all pixels to which pixel data to be generated based on a signal coming from said solid-state image sensor is given.

9. The camera signal processing apparatus as set forth in claim 8, wherein said interpolated pixel data generating means generates said interpolated pixel data by applying a filter $[1, 4, 6, 4, 1]/8$ in said at least two directions.

10. The camera signal processing apparatus as set forth in claim 7, wherein, if a line to be interpolated has no pixel data indicative of a color to be interpolated, said interpolated pixel data generating means generates said pixel data indicative of said color by use of pixel data of a line of substantially a same direction as that of said line to be interpolated and adjacent to thereto.

11. A camera signal processing method comprising the steps of:

interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data; and

weighting said interpolated pixel data in each of said at least two directions with said correlation value in each of said at least two directions and adding the weighted interpolated pixel data in said at least two directions to generate interpolated pixel data.

12. The camera signal processing method as set forth in claim 11, wherein said interpolated pixel data is generated for all pixels to which pixel data to be

generated based on a signal coming from said solid-state image sensor is given.

13. The camera signal processing method as set forth in claim 12, wherein said interpolated pixel data is generated by applying a filter $[1, 4, 6, 4, 1]/8$ in said at least two directions.

14. The camera signal processing method as set forth in claim 11, wherein, if a line to be interpolated has no pixel data indicative of a color to be interpolated, said pixel data indicative of said color is generated by use of pixel data of a line of substantially a same direction as that of said line to be interpolated and adjacent to thereto.

15. A camera signal processing apparatus comprising:

an interpolated pixel data generating means for interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter

having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

an edge processing means for computing a limit value for each of said interpolated pixel data based on pixel data around said each of interpolated pixel data generated by said interpolated pixel data generating means;

a correlation detecting means for detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data generated by said interpolated pixel data generating means;

a weighting means for weighting said interpolated pixel data in each of said at least two directions generated by said interpolated pixel data generating means with said correlation value detected by said correlation detecting means in each of said at least two directions and adding together the weighted interpolated pixel data in all of said at least two directions to generate interpolated pixel data; and

an image generating means for generating an image based on said interpolated pixel data generated by said interpolated pixel data generating means;

wherein said interpolated pixel data generating means generates interpolated pixel data for said pixel data based on said limit value computed by said edge processing means and said image generating means generates said image based on the generated interpolated pixel data.

16. The camera signal processing apparatus as set forth in claim 15, wherein said edge processing means computes said limit value for interpolated pixel data for pixel data indicative of a majority color in all pixel data.

17. A camera signal processing method comprising the steps of:

interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

computing a limit value for each of said interpolated pixel data based on pixel data around said each of interpolated pixel data;

generating, based on said limit value, interpolated pixel data in each of said at least two directions based on said position of said pixel data and said pixel data around said position;

detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data;

weighting said interpolated pixel data in each of said at least two directions with said correlation value of each of said at least two directions and adding together the weighted interpolated pixel data in all of said at least two directions to generate interpolated pixel data; and

generating an image based on the weighted interpolated pixel data.

18. The camera signal processing method as set forth in claim 17, wherein said limit value is computed for interpolated pixel data for pixel data indicative of a majority color in all pixel data.

19. A camera signal processing apparatus comprising:

an interpolated pixel data generating means for interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

a correlation detecting means for detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data generated by said interpolated pixel data generating means;

a noise canceling means for subtracting a predetermined value from said correlation value detected by said correlation value detecting means;

a weighting means for weighting said interpolated pixel data in each of said at least two directions generated by said interpolated pixel data generating means with said correlation value detected by said correlation detecting means in each of said at least two

directions and adding together the weighted interpolated pixel data in all of said at least two directions to generate interpolated pixel data; and

an image generating means for generating an image based on said interpolated pixel data weighted by said weighting means.

20. The camera signal processing apparatus as set forth in claim 19, wherein said noise canceling means has a subtracting means for performing subtraction on the correlation values of said at least two directions and a control means for generating a subtrahend for performing subtraction in said subtracting means,

wherein said subtracting means receives said subtrahend generated by said control means to perform subtraction based on said subtrahend.

21. The camera signal processing apparatus as set forth in claim 19, wherein said noise canceling means comprising:

an absolute value converting means for making absolute the inputted correlation value in each of said at least two directions;

a subtracting means for subtracting a predetermined value from the correlation value made absolute by said absolute value converting means in each of said at least two directions; and

a limiting means for limiting said correlation value subtracted by said subtracting means in each of said at least two directions to a positive value.

22. A camera signal processing method comprising the steps of:

interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data;

subtracting a predetermined value from said correlation value; and

weighting said interpolated pixel data in each of said at least two directions with the subtracted correlation value in each of said at least two directions to generate interpolated pixel data obtained by adding together the weighted interpolated pixel data in all of said at least two directions.

23. The camera signal processing method as set forth in claim 22, wherein subtraction is performed on said correlation value in each of said at least two directions based on an inputted subtrahend.

24. The camera signal processing method as set forth in claim 22, wherein the inputted correlation value in each of said at least two directions is made absolute, a predetermined value is subtracted from the absolute correlation value in each of said at least two directions, and the subtracted correlation value in each of said at least two directions is limited to a positive value.

25. A camera signal processing apparatus comprising:

an interpolated pixel data generating means for interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

a correlation detecting means for detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data generated by said interpolated pixel data generating means;

an offset means for adding a predetermined value to the correlation value detected by said correlation detecting means in each of said at least two directions;

a weighting means for weighting said interpolated pixel data generated by said interpolated pixel data generating means in each of said at least two directions with the correlation value added by said offset means in each of said at least two directions and adding together the weighted interpolated pixel data in all of said at

least two directions to generate interpolated pixel data;
and

an image generating means for generating an image
based on said interpolated pixel data weighted by said
weighting means.

26. The camera signal processing apparatus as
set forth in claim 25, further comprising:

a control means for generating an offset value
indicative of said predetermined value;
wherein said offset means adds said offset value
generated by said control means to said correlation value
in each of said at least two directions.

27. The camera signal processing apparatus as
set forth in claim 26, wherein said control means
generates said offset value by varying the magnitude of
said offset value according to pixel data detected by
said solid-state image sensor.

28. A camera signal processing method comprising
the steps of:

interpolating pixel data in at least two
directions based on a position of said pixel data and/or

pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data;

adding a predetermined value to the correlation value in each of said at least two directions;

weighting said interpolated pixel data in each of said at least two directions with the correlation value added with said predetermined value and adding together the weighted interpolated pixel data in all of said at least two directions to generate interpolated pixel data; and

generating an image based on the weighted interpolated pixel data.

29. The camera signal processing method as set forth in claim 28, wherein an offset value indicative of said predetermined value is generated and

the generated offset value is added to the said correlation value in each of said at least two direction.

30. The camera signal processing method as set forth in claim 29, wherein said offset value is generated by varying the magnitude of said offset value according to said pixel data detected by said solid-state image sensor.

31. A camera signal processing apparatus comprising:

an interpolated pixel data generating means for interpolating pixel data to be generated according to a signal coming from a solid-state image sensor in which a light enters through a color filter having a different spectral characteristic for each pixel to provide interpolated pixel data based on a position of said pixel data and/or pixel data around said position;

a correlation detecting means for detecting a correlation value for indicating a degree of correlation between a horizontal direction and a vertical direction of said interpolated pixel data generated by said interpolated pixel data generating means to weight said interpolated pixel data; and

an image generating means for generating an image based on interpolated pixel data obtained by weighting said interpolated pixel data generated by said interpolated pixel data generating means with said correlation value detected by said correlation detecting means;

wherein said correlation detecting means uses only pixel data indicative of a predetermined color in pixel data detected by said solid-state image sensor to detect a correlation value for interpolated pixel data indicative of said predetermined color and a correlation value for interpolated pixel data indicative of a color other than said predetermined color.

32. The camera signal processing apparatus as set forth in claim 31, wherein said correlation detecting means uses only pixel data having substantially a same color as that of said interpolated pixel data and uses a band-pass filter $[-1, 0, 2, 0, -1]$ and a low-pass filter $[1, 0, 6, 0, 1]/8$ and to detect said interpolated pixel data indicative of said predetermined color.

33. The camera signal processing apparatus as set forth in claim 31, wherein said correlation detecting

means uses only pixel data of said predetermined color and uses a band-pass filter $[-1, 0, 2, 0, -1]$ and a low-pass filter $[1, 0, 1]/2$ to detect said correlation value for said interpolated pixel data indicative of a color other than said predetermined color.

34. The camera signal processing apparatus as set forth in claim 32, further comprising:

a control means for controlling said correlation detecting means;

wherein said correlation detecting means detects said correlation value without using said low-pass filter according to a control signal coming from said control means.

35. A camera signal processing method comprising the steps of:

interpolating pixel data to be generated according to a signal coming from a solid-state image sensor in which a light enters through a color filter having a different spectral characteristic for each pixel to provide interpolated pixel data based on a position of said pixel data and/or pixel data around said position;

detecting a correlation value for interpolated pixel data indicative of a predetermined color and a correlation value for interpolated pixel data indicative of a color other than said predetermined color by using only pixel data indicative of said predetermined color;

weighting said interpolated pixel data with said correlation value; and

generating an image based on the weighted interpolated pixel data.

36. The camera signal processing method as set forth in claim 35, wherein said correlation value for said interpolated pixel data indicative of said predetermined color is detected by use of only pixel data having substantially a same color as that of said interpolated pixel data and by use of a band-pass filter $[-1, 0, 2, 0, -1]$ and a low-pass filter $[1, 0, 6, 0, 1]/8$.

37. The camera signal processing method as set forth in claim 35, wherein said correlation value for said interpolated pixel data indicative of a color other than said predetermined color is detected by use of only said pixel data indicative of said predetermined color

and by use of a band-pass filter $[-1, 0, 2, 0, -1]$ and a low-pass filter $[1, 0, 1]/2$.

38. The camera signal processing method as set forth in claim 36, wherein said correlation value for said pixel data indicative of said predetermined color is detected without using said low-pass filter.

39. A camera signal processing apparatus comprising:

an interpolated pixel data generating means for interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

a correlation detecting means for detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data generated by said interpolated pixel data generating means;

an emphasis/deemphasis means for performing control whether said interpolated pixel data is to be generated by emphasizing the correlation depending on said correlation value detected by said correlation detecting means in each of said at least two directions; a weighting means for weighting said interpolated pixel data in each of said at least two directions generated by said interpolated pixel data generating means with the correlation value controlled by said emphasis/deemphasis means in each of said at least two directions and adding together the weighted interpolated pixel data in all of said at least two directions to generate interpolated pixel data; and an image generating means for generating an image based on said interpolated pixel data weighted by said weighting means.

40. The camera signal processing apparatus as set forth in claim 39, further comprising:
a control means for controlling said emphasis/deemphasis means;
wherein said control means outputs to said emphasis/deemphasis means a control signal for varying a slope of an input/output characteristic of said

correlation value in each of said at least two directions, thereby controlling said emphasis/deemphasis means.

41. The camera signal processing apparatus as set forth in claim 40, further comprising:

a subtracting means for subtracting a predetermined value from said correlation value detected by said correlation detecting means in each of said at least two directions; and

an adding means for adding said predetermined value to the correlation value subtracted by said subtracting means in each of said at least two directions;

wherein said predetermined value is subtracted by said subtracting means from said correlation value detected by said correlation detecting means in each of said at least two directions and then a slope of an input/output characteristic of said correlation value in each of said at least two directions is varied by said emphasis/deemphasis means to add said predetermined value by said adding means.

42. The camera signal processing apparatus as set forth in claim 40, further comprising:

a limiting means for limiting a range of said correlation value in each of said at least two directions;

wherein said limiting means limits said range of said correlation value in each of said at least two directions of which slope of the input/output characteristic has been varied by said emphasis/deemphasis means.

43. The camera signal processing apparatus as set forth in claim 39, further comprising:

a normalizing means for generating a normalized value indicative of a relative value of said correlation value in each of said at least two directions by normalizing said relative value detected by said correlation detecting means in each of said at least two directions;

wherein said emphasis/deemphasis means varies a slope of said normalized value generated by said normalizing means.

44. A camera signal processing method comprising the steps of:

interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data;

performing control whether said correlation is to be emphasized depending on said correlation value in each of said at least two directions;

weighting said interpolated pixel data in each of said at least two directions with the correlation value in each of said at least two directions of which degree of correlation emphasis is controlled and adding together the weighted interpolated pixel data in all of said at least two directions to generate interpolated pixel data;

and

generating an image based on said weighted interpolated pixel data.

45. The camera signal processing method as set forth in claim 44, wherein a control signal for varying a slope of an input/output characteristic of said correlation value in each of said at least two directions is generated and

control is performed by said control signal whether the correlation is to be emphasized depending on said correlation value in each of said at least two directions.

46. The camera signal processing method as set forth in claim 45, wherein:

a predetermined value is subtracted from said correlation value in each of said at least two directions; and

said predetermined value is added to the subtracted correlation value in each of said at least two directions;

wherein;

said predetermined value is subtracted from said correlation value in each of said at least two directions

and then a slope of an input/output characteristic of said correlation value in each of said at least two directions is varied to add said predetermined value by said adding means.

47. The camera signal processing method as set forth in claim 45, wherein said slope of said input/output characteristic is varied by limiting a range of said correlation value in each of said at least two directions.

48. The camera signal processing method as set forth in claim 44, wherein said correlation value in each of said at least two directions is normalized to generate a normalized value indicative of a relative value of said correlation value in each of said at least two directions and a slope of said normalized value is varied.

49. A camera signal processing apparatus comprising:

an interpolated pixel data generating means for interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on

an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

a correlation detecting means for detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data generated by said interpolated pixel data generating means;

a color-difference signal detecting means for detecting a color-difference signal of each of said interpolated pixel data in each of said at least two directions generated by said interpolated pixel data generating means and interpolated pixel data added with said correlation value detected by said correlation detecting means in each of said at least two directions;

a selecting means for selecting a smallest one of the color-difference signal of said interpolated pixel data in each of said at least two directions and the color-difference signal of the interpolated pixel data computed by use of said correlation value in each of said at least two directions; and

an image generating means for generating an image based on the interpolated pixel data selected by said selecting means.

50. The camera signal processing apparatus as set forth in claim 49, further comprising:

a control means for controlling said selecting means;

wherein said control means controls said selecting means such that the selecting means selects one of the color-difference signal of said interpolated pixel data in each of said at least two directions and the color-difference signal of the interpolated pixel data computed by use of said correlation value in each of said at least two directions.

51. The camera signal processing apparatus as set forth in claim 49, wherein said selecting means selects the smallest of the color-difference signals having at least a predetermined value.

52. The camera signal processing apparatus as set forth in claim 49, further comprising:

an absolute value converting circuit for making absolute the color-difference signals of said interpolated pixel data in each of said at least two directions and said interpolated pixel data computed by use of said correlation value in each of said at least two directions;

wherein said selecting means selects a smallest color-difference signal outputted from said absolute value converting circuit.

53. A camera signal processing method comprising the steps of:

interpolating pixel data in at least two directions based on a position of said pixel data and/or pixel data around said position, said pixel data being generated based on an imaging signal coming from a solid-state image sensor in which an imaging light enters through a color filter having a different spectral characteristic for each pixel, thereby separately generating interpolated pixel data in said at least two directions;

detecting a correlation value indicative of a degree of correlation in each of said at least two directions of said interpolated pixel data;

detecting a color-difference signal of each of said interpolated pixel data in each of said at least two directions and interpolated pixel data added with said correlation value in each of said at least two directions;

selecting a smallest one of the color-difference signal of said interpolated pixel data in each of said at least two directions and the color-difference signal of the interpolated pixel data computed by use of said correlation value in each of said at least two directions; and

generating an image based on the selected interpolated pixel data.

54. The camera signal processing method as set forth in claim 53, wherein one of the color-difference signal of said interpolated pixel data in each of said at least two directions and the color-difference signal of the interpolated pixel data computed by use of said correlation value in each of said at least two directions is selected.

55. The camera signal processing method as set forth in claim 53, wherein the smallest one of the color-

difference signals having at least a predetermined value is selected.

56. The camera signal processing method as set forth in claim 53, wherein color-difference signals of vertically interpolated pixel data, horizontally interpolated pixel data, and said interpolated pixel data computed by use of said correlation value are made absolute and

the smallest one of the absolute color-difference signals is selected.